plane perpendicular to the axis of the guide and is spaced from the face of the following choke by the outer protective jacket. This jacket also enables the guide to be pressurized. This type of guide

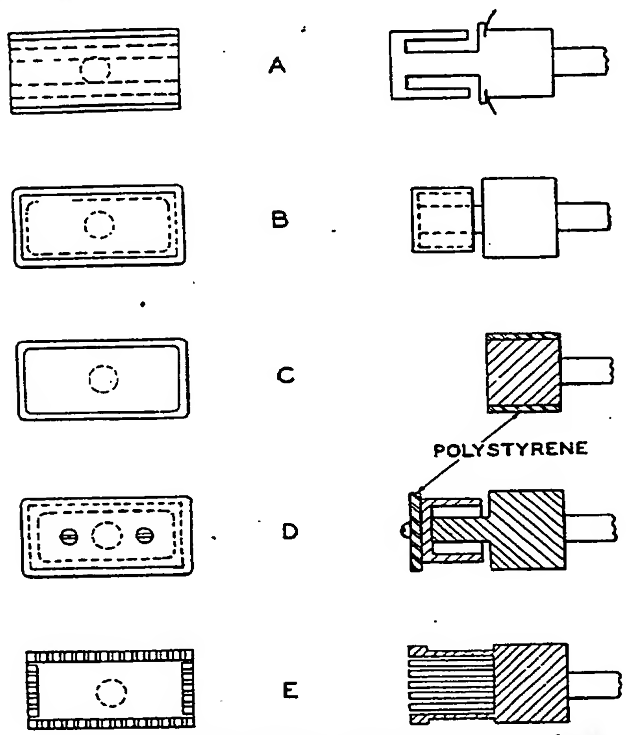

FIG. 10-15.—Miscellaneous wave-guide shorting plugs.

is very flexible, but the chokes must be carefully designed to avoid resonances when the guide is twisted or bent.

5. Shorting Plugs for Wave Guides

Various types of shorting plugs have been used for rectangular wave guides. Some of these are illustrated in Fig. 10-15. The ones shown were constructed and tested in 1 by ½ by 0.050-in. wall guide, and the losses were compared with the loss introduced by a brass plate soldered on the end of the wave guide. The results are given in Table 10-1.

The losses in types A to D do not vary greatly with age, but the losses introduced by type E have been observed to increase markedly with age and depend upon the stiffness of the fingers. The preceding

TABLE 10-1

Type of Plug	Measured Loss, db
A. Silver plated	0.001
B. Silver plated	0.005–0.006
C. Silver plated	0.015–0.025
D. Silver plated	0.017–0.035
E. Brass	0.038

measurements were made with a freshly cleaned plug and wave guide. These results should be taken as only indicative of what might be expected from similar designs.

6. Coupling through Holes in Wave Guides

Circular Wave Guides.[5]—Consideration is limited to wave guides that are above cutoff for the dominant mode only. The equivalent circuit of a small centered hole in an infinitely thin diaphragm normal to the guide axis is an inductive susceptance shunting the guide. For a guide of diameter $2a$ and a hole of diameter d, the normalized susceptance is

$$\frac{B}{Y_0} = \frac{\lambda_g}{4a}\left(5.71\,\frac{a^3}{d^3} - 2.344\right) \quad (10\text{-}4)$$

This is plotted in Fig. 10-16. The insertion loss is given by

$$\alpha_1 = 10 \log_{10}\left[\frac{\left(\frac{B}{Y_0}\right)^2}{4} - 1\right] \quad \text{db} \quad (10\text{-}5)$$

or for large B/Y_0,

$$\alpha_1 \cong 20 \log_{10} \frac{\left(\frac{B}{Y_0}\right)}{2} \quad (10\text{-}6)$$

If the hole is of appreciable thickness t, the total insertion loss α_T will be given approximately by

$$\alpha_T = \alpha_1 + \alpha_2 \quad (10\text{-}7)$$

where α_2 is the attenuation in a below cutoff wave guide given by

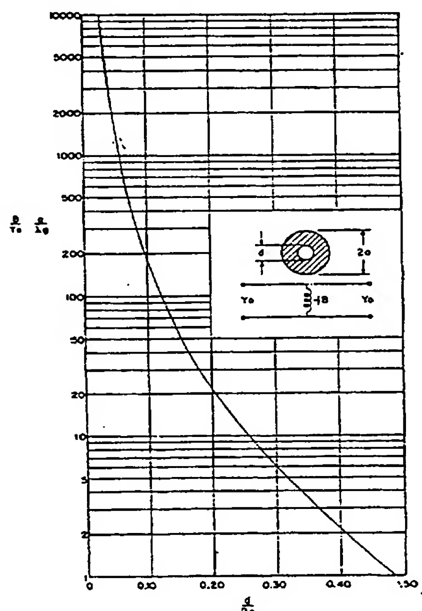

FIG. 10-16.—Theoretical susceptance of a small centered hole in a thin diaphragm in a circular wave guide.

[5] "Waveguide Handbook Supplement," M.I.T. Radiation Laboratory, Rept. 41, Jan. 23, 1945 A.